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OPTIMIZATION OF CUTTING SPEED PARAMETER FOR ROUNDNESS STUDY IN WIRE EDM FOR DIFFERENT MATERIALS BY TAGUCHI METHOD

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ABSTRACT

In the present paper review is directed of test investigations did to consider the impact of EDM parameters on cutting speed (CS), electrode (EWR), surface roughness (Ra) and dia material over cut in erosion safe tempered steels. The non-contact machining method has been constantly advancing from a negligible device and bite the dust making procedure to a small scale application machining elective pulling in a lot of research interests and Electro chemical machining (ECM) offers a few extraordinary favorable circumstances including higher machining rate, better accuracy and control, and a more extensive scope of materials that can be machined The objective of this paper is to present the results of a study on the effect of the wire electric discharge machining of stainless steel SS-316, H13 and EN24 for machining in W- EDM. The present research focuses on the roundness parameters for different materials and at different thickness.

KEYWORDS: W-EDM, Roundness & TAGUCHI

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Original Article

INTRODUCTION

EDM is most widely and successfully applied process in machining of hard metals or those that would be very difficult to machine with traditional techniques. The material is removed from the work piece by the thermal disintegration process, i.e., by a progression of repeating electrical discharges between a cutting apparatus going about as a electrode and a conductive work piece within the sight of a dielectric fluid This discharge happens in a voltage gap (Vg) between the electrode and work piece. Heat from the release vaporizes minute particles of work piece material, which are then washed from the hole by the consistently flushing dielectric fluid This technology is progressively being utilized as a part of hardware, pass on and form making businesses, for machining of warmth treated apparatus steels and propelled materials (super compounds, earthenware production, and metal grid composites) requiring high exactness, complex shapes and high surface finish. Customary machining procedure is frequently in view of the material evacuation utilizing instrument material harder than the work material and can't machine them economically.

EDM is a standout amongst the most popular non-traditional evacuations process and has turned out to be essential machining strategy for the assembling businesses of aviation, car, atomic and restorative with the

expanding requests of high surface complete and machining of complex shape geometries, regular machining process are presently being supplanted by non-conventional machining processes.

Wire-cut EDM Wire

EDM additionally called electric discharge wire cutting procedure utilized for delivering a few dimensional complex shapes utilizing an electro warm system for dissolving the material from a thin single stranded by direct rulers metal wire encompassed by deionized water which is utilized to lead power. Any hard material can cut by wire EDM process, yet the material ought to have an electrical conductive properties. The anode wire is usually made of metal or copper material. The diameter range of wire is 0.5 to 0.25 mm. The wire is wound on a two wire spool which is rotated in the same direction to strand the wire. The speed of wire movement is up to 3 m/min.

LITERATURE REVIEW

P. srinivasarao et. al. [1]considered the impact of the most relevant EDM factors over MRR, device wear rate (TWR), Ra and hardness of ss 304 by copper tool electrode. So as to accomplish factorial plan of tests and numerous relapses examination procedures have been utilized to show the already specified reaction factors by methods for conditions as polynomials. On account of MRR, all the plan factors are affecting for a certainty level of 95% and orchestrated in plunging request of significance, servo voltage, obligation cyle, current and voltage keeping in mind the end goal to acquire the high estimation of MRR the work interim of present, servo and obligation cycle (t) ought to be settled as high as could be expected under the possible

AsifIqbal et. al.[2]built up experimental relations with respect to machining parameters and the reactions in examining the machinability of the SS 304 utilizing copper anode. The machining factors utilized were voltage, rotational speed of cathode and feed rate over the reactions MRR, EWR and SR. The reaction surface procedure was utilized to investigate the connections and parametric interactions between the three control factors on the MRR, EWR and SR. The created models demonstrate that the voltage and revolving movement of anode are the most critical machining parameters impacting MRR, EWR and SR

S. Gopalakannan et. al. [3] investigated the impact of beat current on material removal rate, electrode wear, surface roughness and diameteral over cut in erosion safe treated steels viz., ss316 L and 17-4 PH. They watched that the yield parameters, for example, MRR, EWR and Ra of EDM increment with increment in beat current. The outcomes uncover that high MRR have been accomplished with copper terminal though copper-tungsten yielded bring down electrode wear, smooth surface complete and great dimensional accuracy.

R. Thanigaivelan et. al.[4] examined the impact and parametric streamlining of process parameters for electro chemical micro machining (EMM) of SS 304 utilizing dim social investigation, by utilizing machining voltage, beat on-time, electrolyte focus and apparatus tip shapes as common process parameters The trial comes about uncovered that, the conelike with adjusted anode, machining voltage of 9V, pulse on-time of 15ms and electrolyte convergence of 0.35mole/l was the ideal blend for higher machining rate and lesser over cut. The test comes about for the ideal setting demonstrated that there was significant change all the process.

METHODOLOGY

In this experiment and parametric streamlining of process parameters for electro chemical micro machining (EMM) of SS 304 utilizing dim social investigation, by utilizing machining voltage, beat on-time, electrolyte focus and apparatus tip shapes as common process parameters The trial comes about uncovered that, the cone like with adjusted anode, machining voltage of 9V, pulse on-time of 15ms and electrolyte convergence of 0.35mole/l was the ideal blend for higher machining rate and lesser over cut. The test comes about for the ideal setting demonstrated that there was construction change all the process. The austenitic arrangement gives these grades brilliant toughness, straight down to bring down hotness. Investigations are led with straight polarity i.e. anode is associated with negative terminal of intensity supply framework. The beat release voltage is connected in different advances. Outer weight flushing is utilized to flush the EDM oil between the spark gap. Fast Steel is utilized as a work piece material and a round and hollow molded copper instrument with 6 mm in width is utilized as a cathode. The format of plan of examination depends on L9 symmetrical cluster. In this investigation beat off time, obligation cycle, flushing pressure, spark gap and grouping of powder are kept consistent 8µs, 6%, 0.3 kgf/cm2, 0.02 mm and 10g/l respectively. A steady spark gap can be kept up with the assistance of a servo control instrument. Add up to eighteen number of trials are performed out of which nine analyses are directed by utilizing EDM oil as a dielectric medium and the staying nine tests are led by utilizing Silicon powder blended EDM oil as dielectric medium. An electronic measuring machine is utilized to measure the work piece when try for calculation of material removal rate. The limit of measuring machine is 300 gram and accuracy is 0.001 gram

Selection of Tool Material

In this analysis copper wire cut is utilized. Tungsten carbide items are celebrated for their heat resistance, sturdiness and great machinability. One of the results of tungsten carbide are the strong tungsten carbide bars that are utilized for cutting divergent composites, cast press, treated steel, unmanageable amalgam steel, nickel based compound, titanium combination and different nonferrous metals. The strong tungsten carbide poles are offered as a ground and un ground with metric or inch guidelines. These poles have the highlights of good wear obstruction and corrosion resistance.

Mechanism of Cutting Speed CS

System behind material expulsion of EDM process depends on the change of electrical energy to thermal energy that ordered it to electro thermal process. Amid machining both the surfaces may have exhibit smooth and anomalies causes least and most extreme hole in the middle of hardware and work piece. At a given moment at least point reasonable voltage is created produces electrostatic field for outflow of electrons from the cathode there electrons quickened towards the anode.

Characteristics of Cutting Speed CS

- The process can be used to machine any work material if it is electrically conductive
- Cutting speed **CS** depends on mainly thermal properties of the work material rather than its strength, hardness etc
- In cutting speed **CS** there is a physical tool and geometry of the tool is the positive impression of the whole or geometric feature machined
- The tool has to be electrically conductive as well. The tool wear once again depends on the thermal properties of the tool material

- Though the local temperature rise is rather high, still due to very small pulse on time, there is not enough time for the heat to diffuse and thus almost no increase in bulk temperature takes place.

Table 1: Specification on Cutting Speed CS

Characteristics	Range
Mechanism of process	Controlled erosion i.e. melting and evaporation aided by cavitation
Spark gap	10 - 125 µm
Spark frequency	200 – 500 kHz
Maximum material removal rate	5000 mm3 /min
Shape application	Micro-holes for nozzles, thin slots, visionless complex craters.

EXPERIMENTAL ANALYSES

Experimental works have been undertaken for data collection on the Die Sinking EDM placed in the CNC Laboratory of Tool Room Training Centre, The experiments were conducted on a die-sinking EDM. Its specifications are given in Table. Straight polarity was used throughout the experiment. During experiment, there were some parameters which were kept constant throughout.

Standard Notations

On=005

Off=016

HP=002

MA=19

SV=021

V=3

SF=0005

C=00

Parameters

Materials -1a, 1b, 1c-EN24, H13, SS316

Thickness- 2a, 2b- 6mm, 10mm

Head height(gap between nozzles)- 3a, 3b- 9mm, 29mm.

Layout Using an L12 Orthogonal Array

Table 2

Experiments	CS A	CS B	CS C
Number	Material	Height (h)	Thickness t
1	1a	2a	3a
2	1a	2b	3a
3	1a	2a	3b
4	1a	2b	3b

Table 2: Contd.,			
5	1b	2a	3a
6	1b	2b	3a
7	1b	2a	3b
8	1b	2b	3b
9	1c	2a	3a
10	1c	2b	3a
11	1c	2a	3b
12	1c	2b	3b

Experimental data of cutting speed for

D1= dia 10mm

D2= dia12mm

P1= diaprofile 1

P2= diaprofile 2

D3= dia14mm

S. No	Cutting Speed mm/min				
	D1	D2	Profile 1	Profile 2	D3
1	5.68	5.66	5.6	5.68	5.66
2	5.66	5.64	5.64	5.66	5.66
3	4.68	4.66	4.66	4.68	4.64
4	4.64	4.62	4.60	4.62	4.64
5	5.62	5.62	5.60	5.60	5.62
6	5.60	5.64	5.62	5.60	5.62
7	4.64	4.62	4.66	4.64	4.62
8	4.60	4.58	4.62	4.60	4.62
9	5.60	5.62	5.62	5.60	5.60
10	5.58	5.57	5.58	5.60	5.57
11	4.70	4.72	4.72	4.70	4.70
12	4.68	4.66	4.66	4.68	4.66

CONCLUSIONS

- L12 orthogonal array formed to complete the practical experiments by varying parameters.
- Tool steel materials observed to be finding at micron level finishing and errors are very less.
- SS316 given good result in primary cutting observed at different nozzle heights.

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